Original article

# A study of prevalence and associated factors of COPD exacerbation among COPD patients at Sanamchaikhet Hospital, Chachoengsao Province, Thailand

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***Abstract:***

***Background:*** *Exacerbation of COPD is a significant condition that has several undesirable impacts on health aspects and socioeconomic aspects. There has been lacking study of COPD exacerbation in Thailand so far, particularly in rural areas. This study aimed to determine the prevalence and associated factors of COPD exacerbation.* ***Methods:*** *This was a cross-sectional study conducted on COPD patients (diagnosed according to Global Initiative for Chronic Obstructive Lung Disease diagnostic criteria) at Sanamchaikhet Hospital, Chachoengsao Province, Thailand from 1st September 2017 to 1st September 2018. The relevant variables (sex, age, body mass index, occupation exposure to dust/fume/gas, smoking status, passive smoking, severity of airflow limitation, respiratory infections, comorbidity, COPD medication, inhalation techniques, influenza vaccination, compliance, and follow-up) were collected and statistically analyzed.* ***Result:*** *There were 150 COPD patients included in this study. The majority were males (79%), the mean age was 66.29±9.42 years old. The prevalence of COPD exacerbation was 47.3% with the highest frequency of exacerbation in January as 30 times (14.29%). Multivariable analysis revealed that pneumonia (OR 10.52, 95%CI: 1.78-62.08, p = 0.009), using triple therapy (LABA and ICS plus LAAC) (OR 7.74, 95%CI; 2.45-24.46, p < 0.001), poor compliance (OR 3.33, 95%CI: 1.24-8.92, p = 0.017), good inhalation techniques (OR 0.182, 95%CI: 0.06-0.51, p = 0.001) and loss of follow up (OR 42.055, 95%CI: 9.18-192.55, p < 0.001) were independently associated with COPD exacerbation.* ***Conclusion:*** *The prevalence of COPD exacerbation was comparatively high in Thailand. Five associated factors were identified. Inhalation techniques, poor compliance, and loss of follow-up should be modified as well as pneumonia that should be prevented. Regarding the use of triple therapy (LABA and ICS plus LAAC), further research should be performed to determine this associated factor.*

***Keywords:*** ● *Chronic obstructive pulmonary disease* ● *Exacerbation* ● *Prevalence* ● *Associated factors*

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## นิพนธ์ต้นฉบับ

# การศึกษาความชุกและปัจจัยที่เกี่ยวข้องกับการกำเริบของโรคปอดอุดกั้นเรื้อรังในโรงพยาบาลสนามชัยเขต จังหวัดฉะเชิงเทรา

ชนัญชิดา นุ่มน้อย สัญชัย ธุระกิจ ปภาณิน นุ่มประสงค์ บุญทรัพย์ ศักดิ์บุญญารัตน์ ราม รังสินธุ์ และ วิศิษฐ์ แก้วพุด
วิทยาลัยแพทยศาสตร์พระมงกุฎเกล้า

***บทคัดย่อ***

***ที่มาและความสำคัญ*** *การกำเริบของโรคปอดอุดกั้นเรื้อรังเป็นปัญหาสำคัญที่ส่งผลกระทบทางร่าง กาย เศรษฐกิจ และ สังคม ปัจจุบันยังมีการศึกษาวิจัยปัจจัยเสี่ยงและความชุกของการกำเริบของโรค ปอดอุดกั้นเรื้อรัง ยังมีน้อยในชุมชนชนบทในประเทศไทยดังนั้นผู้วิจัยจึงมีความสนใจในเรื่องนี้* ***วิธีการดำเนินการวิจัย*** *งานวิจัยนี้เป็นงานวิจัยแบบ cross-sectional study ซึ่งศึกษาในผู้ป่วยโรค ปอดอุดกั้นเรื้อรังในโรงพยาบาลสนามชัยเขตจังหวัดฉะเชิงเทรา ในระหว่างวันที่ 3-28 กันยายน 2561 โดยทำการสำรวจประชากรที่วินิจฉัยว่าเป็นโรคปอดอุดกั้นเรื้อรัง ตั้งแต่วันที่ 1 กันยายน 2560 ถึง 1 กันยายน 2561 ข้อมูลเรื่อง เพศ อายุ ดัชนีมวลกาย อาชีพที่สัมผัสกับควันแก๊สเชื้อเพลิง สถานะการสูบบุหรี่ (ไม่เคยสูบบุหรี่ ยังสูบบุหรี่อยู่ และ ไม่เคยสูบบุหรี่) การได้รับควันบุหรี่ทางอ้อม ฤดูกาล ความรุนแรงของการอุดกั้นหลอดลม การติดเชื้อของระบบทางเดินหายใจ ยาของโรคปอดอุดกั้นเรื้อรัง วิธีการใช้ยาพ่น การใช้ยาไม่สม่ำเสมอ การได้รับวัคซีนไข้หวัดใหญ่ การติดตามการรักษาถูกเก็บรวบรวม จากข้อมูลของคนไข้และนำมาวิเคราะห์ข้อมูล* ***ผลการศึกษา*** *ผู้เข้าร่วมวิจัยทั้งสิ้น 150 คน ตามเกณฑ์ในการคัดเข้าและแยกออกของผู้เข้าร่วมวิจัย โดยส่วนใหญ่เป็นผู้ชาย (79%), อายุเฉลี่ย 66.29 ปี (SD = 9.422) ความชุกของการกำเริบของโรคปอดอุดกั้นเรื้อรัง ร้อยละ 47.3 ด้วยความถี่มากที่สุดในเดือนมกราคม 30 ครั้ง (14.29%) multivariable analysis ปัจจัยที่สัมพันธ์กับการเกิดการกำเริบของโรคปอดอุดกั้นเรื้อรัง คือโรคปอดอักเสบ (OR 4.605, 95%CI: 1.439-14.440, p-value = 0.010) การไม่ฉีดวัคซีนไข้หวัดใหญ่ (OR 0.347, 95%CI: 0.168-0.715, p-value = 0.004) การใช้ยาแบบ triple therapy (OR 1.962, 95%CI: 1.004-3.883, p-value = 0.048) การใช้ยาพ่นถูกวิธี (OR 0.301, 95%CI: 0.154-0.589, p-value < 0.001) และ การไม่มาติดตามการรักษาตามนัด (OR 21.591, 95%CI: 7.125-65.426, p-value < 0.001)* ***สรุป*** *ความชุกของการกำเริบของโรคปอดอุดกั้นเรื้อรัง ร้อยละ 47.3 ซึ่งมากกว่าความชุกของการ กำเริบในประเทศไทยโดยพบห้าปัจจัยที่มีผลกับการกำเริบของโรคปอดอุดกั้นเรื้อรัง คือ วิธีการใช้ยาพ่น การใช้ยาไม่สม่ำเสมอ การขาดนัดการรักษาซึ่งสามารถแก้ไขได้ โรคปอดอักเสบควรมีมาตรการป้องกัน และ การใช้ยาสามชนิด (LABA และ ICS plus LAAC) ควรมีการทำการศึกษาเพิ่มเติมต่อไป*

***คำสำคัญ:*** ● *โรคปอดอุดกั้นเรื้อรัง* ● *การกำเริบของโรคปอดอุดกั้นเรื้อรัง* ● *ความชุก* ● *ปัจจัยที่เกี่ยวข้อง*

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## Introduction

Chronic obstructive pulmonary disease (COPD) is a life-threatening lung disease that can cause exacerbations and serious illness.[1] COPD is a major public health problem which is likely to rank 7th as a global burden of disease[2] and is likely to become the 4th leading cause of death and the 7th leading cause of DALYs worldwide by 2030.[3] The prevalence and burden of the disease are expected to rapidly increasing.[4] The Global Burden of Disease Study reported the prevalence of 251 million cases of COPD globally in 2016.[1] The overall estimated prevalence of COPD in Asia-Pacific region was 6.2%, ranging from 4.5% in Indonesia to 9.5% in Taiwan, while that in Thailand was estimated at 5.3%.[5] About one-fifth of the subjects were identified as having severe or very severe COPD.[5] Approximately 46% of the subjects reported experiencing one or more exacerbations during 12 months prior to the survey, of which Thailand has the highest frequency in exacerbation.[5]

Exacerbation of COPD is an acute event characterized by a deterioration of respiratory symptoms that are beyond usual day-to-day variations leading to a change in medication.[6] The prevalence of COPD-related hospitalization with acute exacerbation in Thailand was 35.8%.[7] Exacerbation of COPD is predicted to cause about 110,000 deaths and more than 500,000 hospitalization per year.[8] COPD is a significant condition that has several undesirable impacts on health aspects and socioeconomic aspects.[8,9] Frequent exacerbations are related to rapid declines of lung function, impaired quality of life, worsen physical activity, and increased mortality rates.[8] Furthermore, consequences of COPD exacerbation result in the largest direct costs for treatment of COPD.[8]

There are several factors that predispose to associate with COPD exacerbation such as increased age[8] smoking status,[8,10,14] low BMI,[10] air pollution,[11] severe airflow limitation,[8,12,14] prior exacerbation,[8,12,13] comorbidity condition (mainly cardiovascular disease),[8,14] persistent symptoms of chronic bronchitis,[8] Influenza non vaccination,[16] improper uses of inhaled devices,[15,16] and seasonality[17]. However, there has been lacking study of COPD exacerbation in Thailand so far, particularly in rural areas. Therefore, we were interested in studying this issue.

This cross-sectional study aimed to determine the prevalence and associated factors of COPD exacerbation at Sanamchaikhet Hospital. Some identified associated factors could be potentially modified. We anticipate not only to prevent the development of COPD exacerbation but also to improve the quality of life and socioeconomic status for patients in the future.

## Materials and methods

This study was designed as a cross-sectional study conducted on COPD patients at Sanamchaikhet hospital, Chachoengsao province, Thailand from 3rd - 28th September 2018. The subjects of this study included patients with age ≥ 40 years old together with a record of COPD diagnosis from 1st September 2017 to 1st September 2018. The enrolled COPD patients were diagnosed according to GOLD diagnostic criteria based on spirometry: post-bronchodilator forced expiratory volume in first second (FEV1) / forced vital capacity (FVC) < 70%.[6] They were excluded from the study if they have incomplete recorded data in the hospital database. According to standard formula, the sample size calculation for prevalence of COPD exacerbation was 198 patients and that for associated factors were 16 in each group. All data were obtained from patient's personal record of COPD clinic documents along with HOSxP program in the hospital's computer database by acquiring informed consent from the Director of Sanamchaikhet Hospital. This study was approved by the Ethical Committee of the Royal Thai Army, Medical Department.

**Data collection**

Relevant variables: sex, age, body mass index (BMI), occupation exposure to dust/gas/fumes, smoking status (non-smoker, current smoker, and ex-smoker), passive smoking, severity of airflow limitation (GOLD stage), respiratory infections, comorbidity, COPD medication, inhalation techniques, annual influenza vaccination, compliance, and follow-up were collected from patient's personal records and analyzed.

**Definition**

The exacerbation of COPD in this study was defined as an acute event characterized by a deterioration of respiratory symptoms (dyspnea, cough, sputum) that are beyond usual day-to-day variations leading to a change in medication or required hospitalization.[6] The GOLD stage was used to classify the severity of airflow limitation which is defined by using FEV1 cut-off points: ≥ 80% classified as mild, ≥ 50% to < 80% classified as moderate, ≥ 30% to ≤ 50% classified as severe, and < 30% classified as very severe airflow limitation.[6] According to the definition proposed by the ministry of public health of Thailand, body mass index (BMI) was calculated as weight divided by height squared ($kg/m^2$). Subjects with BMI < 18.5 were categorized as underweight, those with BMI 18.5-22.9 were categorized as healthy weight, ones with BMI 23-24.9 were categorized as overweight, and those with BMI ≥ 25 $kg/m^2$ were categorized as obesity. In this study, we defined loss of follow-up as missing physician appointment at least once per month. Poor compliance is defined as missing COPD medication at least 2 times per week.

**Statistical analysis**

The data were analyzed by SPSS Statistics 22.0. The variables were analyzed using the Chi-square test or the Fisher's exact test in order to provide prevalence, percentage, mean, and standard deviation. Univariable logistic regressions were performed to determine the relationship of relevant variables and COPD exacerbation by presenting the magnitude of association with crude odds ratio, at the 95% confidence intervals and *p*-value less than 0.05. Then the potential risk factors were analyzed by compelling the confounding factors using multiple logistic regression. The results were displayed as adjusted odds ratio, confidence intervals at the 95% level. P-value less than 0.05 was regarded as statistically significant.

## Results

From 1st September 2017 to 1st September 2018, the total number of COPD patients at Sanamchaikhet Hospital was 278. According to inclusion and exclusion criteria, 150 COPD patients were included in this study. The majority of patients were males (79%), and the mean age was 66.29 years (SD = 9.422). The prevalence of COPD exacerbation was 47.3% (Table 1) with the highest frequency of exacerbation in January as 30 times (14.29%) (Figure 1).

After analyzing several factors by using chi-square test, the study found that COPD exacerbation patients had statistically experienced upper respiratory tract infection (*p*-value = 0.045) and pneumonia (*p*-value = 0.039). In addition, they had statistically poor inhaler

**Table 1** Prevalence of COPD exacerbation at Sanamchaikhet hospital.

| | N | % |
|---|---|---|
| Non- COPD exacerbation | 79 | 52.7 |
| COPD exacerbation | 71 | 47.3 |
| Total | 150 | 100 |

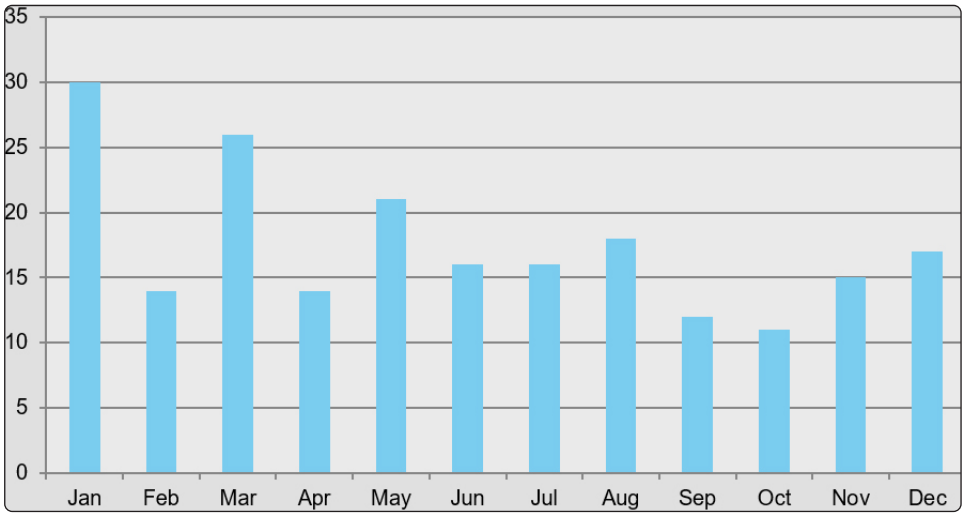


**Figure 1** Frequency of exacerbation each month

techniques ($p$-value < 0.001), lower rates of influenza vaccination ($p$-value = 0.004), poor compliance ($p$-value < 0.001), loss of follow-up ($p$-value < 0.001), and occurring in every month ($p$-value = 0.001) (Table 2).

Univariable analysis showed that associated factors of COPD exacerbation were pneumonia (OR 4.605, 95%CI: 1.439-14.440, $p$-value = 0.010), influenza non-vaccination (OR 0.347, 95%CI: 0.168-0.715, $p$-value = 0.004), using triple therapy (LABA and ICS plus LAAC) (OR 1.962, 95%CI: 1.004-3.883, $p$-value = 0.048), poor inhalation techniques (OR 0.301, 95%CI: 0.154-0.589, $p$-value < 0.001), and loss of follow-up (OR 21.591, 95%CI: 7.125-65.426, $p$-value < 0.001) (Table 3). However, multivariable analysis revealed that experiencing pneumonia was 10.525 times more likely to have COPD exacerbation, statistically significant (95%CI: 1.784-62.085). Using triple therapy (LABA and ICS plus LAAC) was 7.742 times more likely to have COPD exacerbation, statistically significant (95%CI: 2.450-24.464). Poor compliance was 3.334 times more likely to have COPD exacerbation, statistically significant (95%CI: 1.245-8.925). Good inhalation techniques was 5.49 times more likely to prevent COPD exacerbation, statistically significant (95%CI: 0.064-0.515). Loss of follow-up was 42.055 times more likely to have COPD exacerbation, statistically significant (95%CI: 9.185-192.555) (Table 4).

## Discussion

In this research, the prevalence of COPD exacerbation was 47.3%. On a contrary to a previous study[7], despite performing in a similar setting, the prevalence of COPD exacerbation in this study was 1.32 times higher. This is probably due to the difference of associated factors affecting COPD exacerbation between the two studies.

There were 5 associated factors identified for COPD exacerbation: pneumonia, triple therapy (LABA and ICS plus LAAC), poor inhalation techniques, poor compliance, and loss of follow-up. Comparing with this result, a retrospective case-controlled study conducted at Maharaj Nakorn Chiang Mai hospital presented only 1 matched associated factor which was improper use of inhaled devices[16]. Pneumonia is one of respiratory infections which are already well-known an associated factor of COPD exacerbation[14]. Patients should receive vaccination against influenza and pneumococcus to prevent pneumonia. However, Poor compliance and loss of follow-up were associated with COPD exacerbation.

Using triple therapy (LABA and ICS plus LAAC) and poor inhalation techniques were unexpected results in this study. Almost half of the patients (47%) were unable to use inhaled devices properly. The cause of poor inhalation techniques should be determined

**Table 2** General characteristic of COPD patients

| | Non-COPD Exacerbation | COPD Exacerbation | Total | *p*-value |
|---|---|---|---|---|
| | n (%) | n (%) | | |
| **Gender** | | | | 0.280 |
| Female | 19 (61.3) | 12 (38.7) | 31 | |
| Male | 60 (50.4) | 59 (49.6) | 119 | |
| **Age group** | | | | 0.191 |
| 40-49 years old | 6 (75.0) | 2 (25.0) | 8 | |
| 50-59 years old | 16 (51.6) | 15 (48.4) | 31 | |
| 60-69 years old | 32 (61.5) | 20 (38.5) | 52 | |
| 70-79 years old | 19 (40.4) | 28 (59.6) | 47 | |
| ≥ 80 years old | 6 (52.7) | 6 (47.3) | 12 | |
| **BMI ( kg/m$^2$)** | | | | 0.156 |
| < 18.5 | 15 (38.5) | 24 (61.5) | 39 | |
| 18.5-22.9 | 31 (53.4) | 27 (46.6) | 58 | |
| 23-24.9 | 13 (65.0) | 7 (35.0) | 20 | |
| ≥ 25 | 20 (60.6) | 13 (39.4) | 33 | |
| **Smoking status** | | | | 0.226 |
| Non smoker | 13 (54.2) | 11 (45.8) | 24 | |
| Current | 15 (40.5) | 22 (59.5) | 37 | |
| Ex-smoker | 51 (57.3) | 38 (42.7) | 89 | |
| **Amount of smoking (Pack-years)** | | | | 0.749 |
| 0-14 | 39 (54.2) | 33 (45.8) | 72 | |
| 15-29 | 23 (56.1) | 18 (43.9) | 41 | |
| 30-44 | 10 (50.0) | 10 (50.0) | 20 | |
| 45 | 7 (41.2) | 10 (58.8) | 17 | |
| **Passive smoking** | | | | 0.241 |
| No | 54 (56.3) | 42 (43.8) | 96 | |
| Yes | 25 (46.3) | 29 (53.7) | 54 | |
| **Occupation exposure to dust/gas/fumes** | | | | 0.521 |
| No | 54 (54.5) | 45 (45.5) | 99 | |
| Yes | 25 (49.0) | 26 (51.0) | 51 | |
| **Severity of airflow limitation (GOLD stage)** | | | | 0.265 |
| Mild | 20 (43.5) | 26 (56.5) | 41 | |
| Moderate | 37 (60.7) | 24 (39.3) | 61 | |
| Severe | 14 (46.7) | 16 (53.3) | 30 | |
| Very severe | 8 (61.5) | 5 (38.5) | 13 | |

**Table 2** General characteristic of COPD patients (continued)

| | Non-COPD Exacerbation | COPD Exacerbation | Total | *p*-value |
|---|---|---|---|---|
| | n (%) | n (%) | | |
| **Respiratory infections** | | | | |
| **Upper respiratory tract infection** | | | | < 0.045* |
| No | 76 (55.1) | 62 (44.9) | 138 | |
| Yes | 3 (25.0) | 9 (75.0) | 12 | |
| **Bronchitis** | | | | < 0.056 |
| No | 72 (55.8) | 57 (44.2) | 129 | |
| Yes | 7 (33.3) | 14 (66.7) | 21 | |
| **Pneumonia** | | | | 0.039* |
| No | 75 (56.8) | 57 (43.2) | 132 | |
| Yes | 4 (22.2) | 14 (77.8) | 18 | |
| **Pulmonary tuberculosis** | | | | 0.345 |
| No | 67 (54.5) | 56 (45.5) | 123 | |
| Yes | 12 (44.4) | 15 (55.6) | 27 | |
| **Comorbidities** | | | | |
| **Hypertension** | | | | 0.879 |
| No | 48 (52.2) | 44 (47.8) | 92 | |
| Yes | 31 (53.4) | 27 (46.6) | 58 | |
| **Dyslipidemia** | | | | 0.423 |
| No | 45 (50.0) | 45 (50.0) | 90 | |
| Yes | 34 (56.7) | 26 (43.3) | 60 | |
| **Diabetes mellitus** | | | | 0.252 |
| No | 69 (51.1) | 66 (48.9) | 135 | |
| Yes | 10 (66.7) | 5 (33.3) | 15 | |
| **Cardiovascular disease** | | | | 0.450 |
| No | 72 (53.7) | 62 (46.3) | 134 | |
| Yes | 7 (43.8) | 9 (56.3) | 16 | |
| **Inhaler techniques** | | | | <0.001* |
| Poor | 26 (37.1) | 44 (62.9) | 70 | |
| Good | 53 (66.3) | 27 (33.8) | 80 | |
| **Influenza vaccination** | | | | 0.004* |
| No | 16 (34.8) | 30 (65.2) | 46 | |
| Yes | 63 (60.6) | 41 (39.4) | 104 | |
| **Poor compliance** | | | | < 0.001* |
| No | 63 (67.7) | 30 (32.3) | 93 | |
| Yes | 16 (28.1) | 41 (71.9) | 57 | |
| **Loss follow up** | | | | < 0.001* |
| No | 75 (69.4) | 33 (30.6) | 108 | |
| Yes | 4 (9.5) | 38 (90.5) | 42 | |

**Table 2** General characteristic of COPD patients (continued)

| | Non-COPD Exacerbation | COPD Exacerbation | Total | *p*-value |
|---|---|---|---|---|
| | n (%) | n (%) | | |
| **Pharmacological** | | | | |
| **SABA+SAAC (as needed)** | | | | 0.483 |
| No | 4 (66.7) | 2 (33.3) | 6 | |
| Yes | 75 (52.1) | 69 (47.9) | 144 | |
| **ICS alone** | | | | 0.311 |
| No | 71 (52.1) | 67 (47.9) | 138 | |
| Yes | 8 (53.6) | 4 (46.4) | 12 | |
| **LABA+ICS** | | | | 0.503 |
| No | 71 (51.8) | 66 (48.2) | 137 | |
| Yes | 8 (61.5) | 5 (38.5) | 13 | |
| **LAAC+ICS** | | | | 0.368 |
| No | 61 (50.8) | 59 (49.2) | 120 | |
| Yes | 18 (60.0) | 12 (40.0) | 30 | |
| **LABA+ICS+LAAC** | | | | 0.047 |
| No | 37 (62.7) | 22 (37.3) | 59 | |
| Yes | 42 (46.2) | 49 (53.8) | 91 | |
| **Months** | | | | |
| January | | | | <0.001* |
| No | 79 (62.2) | 48 (37.8) | 127 | |
| Yes | 0 (0.0) | 23 (100.0) | 23 | |
| February | | | | <0.001* |
| No | 79 (57.2) | 59 (42.8) | 138 | |
| Yes | 0 (0.0) | 12 (100.0) | 12 | |
| March | | | | <0.001* |
| No | 79 (59.8) | 53 (40.2) | 132 | |
| Yes | 0 (0.0) | 18 (100.0) | 18 | |
| April | | | | <0.001* |
| No | 79 (57.7) | 58 (42.3) | 137 | |
| Yes | 0 (0.0) | 13 (100.0) | 13 | |
| May | | | | <0.001* |
| No | 79 (57.2) | 59 (42.8) | 138 | |
| Yes | 0 (0.0) | 12 (100.0) | 12 | |
| June | | | | <0.001* |
| No | 79 (56.8) | 60 (43.2) | 139 | |
| Yes | 0 (0.0) | 11 (100.0) | 11 | |

**Table 2** General characteristic of COPD patients (continued)

| | Non-COPD Exacerbation | COPD Exacerbation | Total | *p*-value |
|---|---|---|---|---|
| | n (%) | n (%) | | |
| July | | | | < 0.001* |
| No | 79 (57.2) | 59 (42.8) | 138 | |
| Yes | 0 (0.0) | 12 (100.0) | 12 | |
| August | | | | 0.001* |
| No | 79 (56.0) | 62 (44.0) | 141 | |
| Yes | 0 (0.0) | 9 (100.0) | 9 | |
| September | | | | 0.004* |
| No | 79 (55.2) | 64 (44.8) | 143 | |
| Yes | 0 (0.0) | 7 (100.0) | 7 | |
| October | | | | 0.001* |
| No | 79 (56.4) | 61 (43.6) | 140 | |
| Yes | 0 (0.0) | 10 (100.0) | 10 | |
| November | | | | 0.001* |
| No | 79 (56.4) | 61 (43.6) | 140 | |
| Yes | 0 (0.0) | 10 (100.0) | 10 | |
| December | | | | < 0.001* |
| No | 79 (58.1) | 57 (41.9) | 136 | |
| Yes | 0 (0.0) | 14 (100.0) | 14 | |

BMI = body mass index; SABA = short-acting beta2 agonist; SAAC = short-acting anticholinergic; LABA = long-acting beta2 agonist; LAAC = long-acting anticholinergic; ICS = inhaled corticosteroids

**Table 3** Associated factors of COPD exacerbation by univariable analysis

| Variables | OR | 95%CI | *p*-value |
|---|---|---|---|
| Pneumonia | 4.605 | 1.439-14.740 | 0.010* |
| Influenza vaccination | 0.347 | 0.168-0.715 | 0.004* |
| Triple therapy (LABA+ICS+LAAC) | 1.962 | 1.004 - 3.833 | 0.048 |
| Inhalation techniques | 0.301 | 0.154-0.589 | < 0.001* |
| Loss follow up | 21.591 | 7.125-65.426 | < 0.001* |

OR = odd ratio; CI = confidence interval; LABA = long-acting beta2 agonist; LAAC = long-acting anticholinergic; ICS = inhaled corticosteroids

**Table 4** Associated factors of COPD exacerbation by multivariable analysis

| Variables | Adjusted OR | 95%CI | p-value |
|---|---|---|---|
| Pneumonia | 10.525 | 1.784-62.085 | 0.009* |
| Triple therapy (LABA+ICS+LAAC) | 7.742 | 2.450-24.464 | < 0.001* |
| Poor compliance | 3.334 | 1.245-8.925 | 0.017* |
| Inhalation techniques | 0.182 | 0.064-0.515 | 0.001* |
| Loss follow up | 42.055 | 9.185-192.555 | < 0.001* |

OR = odd ratio; CI = confidence interval; LABA = long-acting beta2 agonist, LAAC = long-acting anticholinergic, ICS = inhaled corticosteroids

in order to solve the problem directly. This finding emphasizes the significance of educating patients together with examining on inhaler uses and adherence every follow-up. Those patients need to understand the right steps for their own inhaler devices. In addition, healthcare provider should plan a policy to educating them, particularly, to demonstrate the correct techniques or publishing training videos throughout the hospital. Care givers and other family members should also be educated to support those patients. Although about 33% of patients in this study had received a regular triple therapy (LABA and ICS plus LAAC), they still had COPD exacerbation. An explanation for this result is due to the study design, a cross-sectional study. We cannot determine the temporal relationship between using triple therapy and COPD exacerbation. Thus, further research should be performed to determine this associated factor.

**Limitation**

This study is not without limitations. Firstly, the overall data is a secondary data from hospital database. Therefore, some other potential factors (socioeconomic status, physical activity, and stress level) were not collected and analyzed. Secondly, this study had inadequate sample size which was probably as a result of strict inclusion and exclusion criteria. Thirdly, this study cannot determine the temporal relationship because the study design is cross-sectional study.

## Conclusion

The prevalence of COPD exacerbation at Sanamchaikhet Hospital is 47.3%, which is higher than the prevalence of COPD exacerbation in Thailand[7]. Five associated factors were identified. Poor inhalation techniques, poor compliance, and loss of follow-up should be modified as well as pneumonia that should be prevented. Regarding the use of triple therapy (LABA and ICS plus LAAC), further research should be performed to determine this associated factor.

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